Polar-Wide Geophysical Products Derived from AVHRR

FINAL REPORT

NAG5-4850
Funding Period: 1 July 1997 - 30 June 1998
No-cost Extension Through 31 March 1999

Principal Investigator:

Jeffrey R. Key
Department of Geography
Boston University (BU)

Principal Investigator at Lead Institution:

James Maslanik
University of Colorado at Boulder

July 1, 1999

1.0 Purpose and Scope of this Report

This is the final report for the AVHRR Polar Pathfinder (APP) project activities at Boston University (BU). The grant to J. Key is part of a group proposal with the University of Colorado (CU) as the lead institution (J. Maslanik, PI). The report is a summary of accomplishments over the three-year BU project, although the NASA grant to BU was only for the third year. For the first two years funding at BU was obtained via a subcontract from CU. The overall project report will be provided by the investigators at the University of Colorado this fall, when their no-cost extension period is completed. That report will also contain the information given here. As per NASA guidelines, this report is limited to three pages.

2.0 Project Overview

Monitoring and simulations of polar conditions require a variety of information ranging from sea ice motion to surface energy balance parameters. To provide a significant subset of such information for climate studies, we were funded by the NASA Pathfinder program to generate a multi-year time series of moderate-resolution products derived primarily from 4-km and 1-km Advanced Very High Resolution Radiometer (AVHRR) data. The products being generated are: composited twice-daily radiances and satellite viewing angles, ice displacements, gridded ice velocities generated from combinations of AVHRR displacements, buoy motions, and SSM/I-derived ice motions, a cloud mask, clear-sky surface temperature, and clear-sky broadband surface albedo. These products cover both polar ocean regions as well as the Greenland and Antarctic ice sheets and substantial areas of ice-free land. The combination of archived radiances and derived products supports both future algorithm development and testing by other researchers (using our calibrated and gridded radiances), and polar modeling and monitoring using the surface temperature and albedo products. In addition, by archiving the processed radiances, reanalysis of the AVHRR data as new algorithms reach the production stage is possible with relatively little effort.

3.0 Participants, Responsibilities, and Funding Level

Only one person was supported by this project at BU: J. Key. The level of effort was 0.5, 0.75, and 0.75 months in years 1, 2, and 3, respectively. Key's primary responsibilities were to

1. provide the algorithms and code for cloud detection, the clear-sky surface temperature, and the clear-sky albedo, and

2. examine the products for accuracy (quality control) and refine algorithms are necessary.

The algorithms were developed primarily under other NASA funding, although some effort on this project was devoted to algorithm modifications.

The funding level for the three years was $36,068, which included salary, benefits, over-

head, and one computer workstation. Approximately $11,000 of this total came in the third year as a NASA grant to BU.

4.0 Research Activities and Findings

Since the beginning of the APP project, algorithms for cloud detection, surface temperature, and surface albedo have undergone significant changes. The surface temperature procedure was expanded to include high-latitude land and the south polar region. As a result of problems discovered in Version 0 of the APP product, the cloud detection and surface albedo methods were redesigned. The surface temperature algorithm has been incorporated into the processing scheme at CU; the cloud detection and surface albedo routines will be modified shortly. (CU has, at the time of this writing, approximately four months remaining in their no-cost extension period.)

All algorithms for which the BU part of the project is responsible are being tested with APP radiance data for the SHEBA year. Results for surface temperature and surface albedo (both clear sky) are shown in Figures 1 and 2, where the AVHRR retrievals are compared to measurements made at the ship. AVHRR results are means over a 50x50 km region centered (approximately) on the ship. The large differences on some days are a result of the effects of clouds on the surface energy budget, as the AVHRR retrievals are for clear sky only.

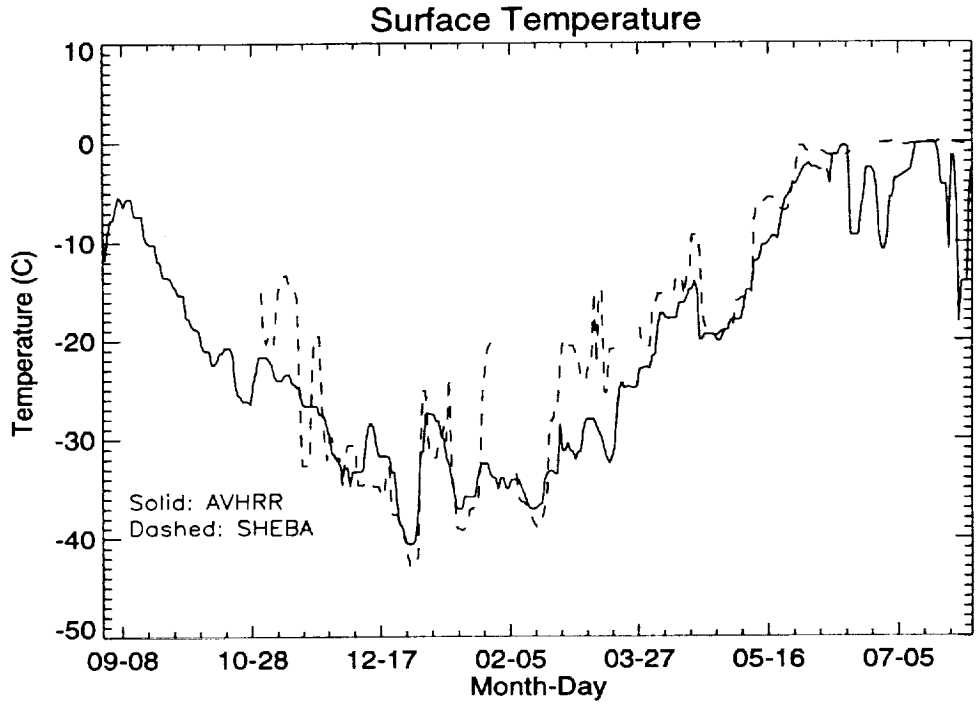

Fig. 1. AVHRR-derived surface temperature and that measured at the SHEBA ship. The ship observation is the 2 m air temperature.

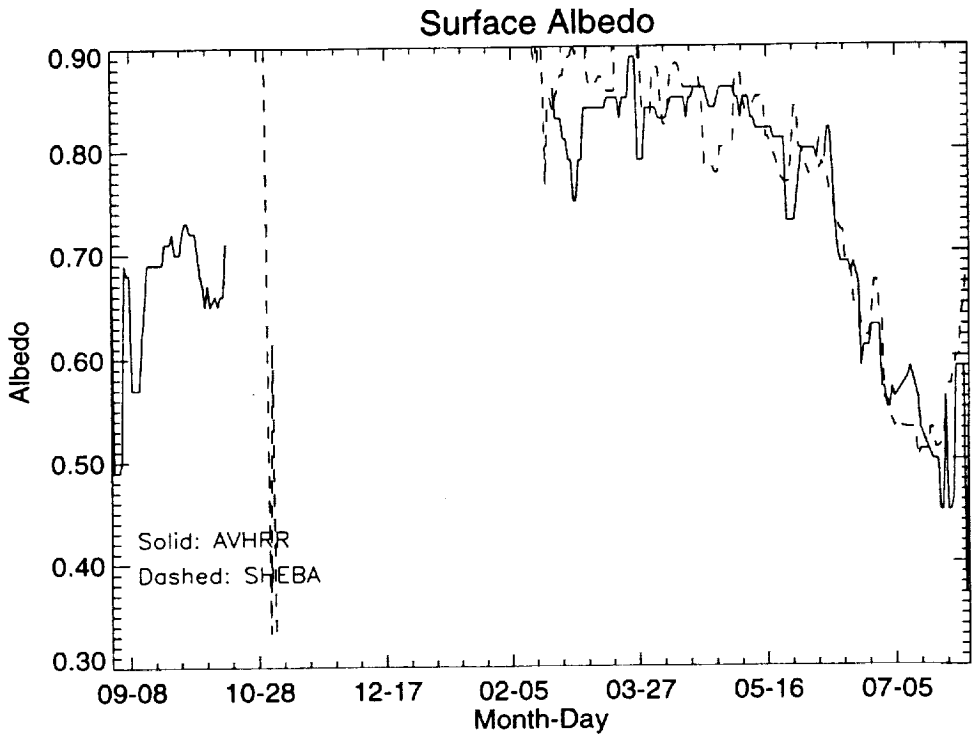

Fig. 2. AVHRR-derived surface broadband albedo and that measured at the SHEBA ship. The ship observation was computed as the ratio of the upwelling to downwelling shortwave fluxes.

In summary, the original objectives have been met: algorithms and code have been delivered to the University of Colorado personnel, the Version 0 products have been examined, and algorithms have been modified as a result and are currently being implemented for the next version of the products.

5.0 Publications Supported in Part by this Grant

Journals

Key, J., J. Collins, C. Fowler, and R. Stone, 1997. High-latitude surface temperature estimates from thermal satellite data. *Remote Sensing Environ.*, 61, 302-309.

Maslanik, J., C. Fowler, T. Scambos, J. Key, and W. Emery, 1997. AVHRR-based polar pathfinder products for modeling applications. *Annals Glaciol.*, 25, 388-392.

Meier, W., J. Maslanik, and J. Key, 1997. Multiparameter AVHRR-derived products for Arctic climate studies. *Earth Interactions*, Vol. 1., October 25.

Published Proceedings

Meier, W., J. Maslanik, J. Key, and C. Fowler, 1996. Energy budget parameters from AVHRR data: A time series for the Beaufort Sea. *IGARSS'96 Digest*, Lincoln, Nebraska, May, Vol. 1, 73-75.